My invention relates generally to earthworking machines and more particularly to self-propelled earthworking machines which are capable of digging, carrying and distributing large quantities of earth materials.

The general object of my invention is to provide an improved latching arrangement and mechanism for the load carrying buckets of self-propelled earthworking machines of the multiple telescoping bucket type.

Another object of my invention is to provide an effective and positive latch-release arrangement and mechanism for the load carrying buckets above mentioned.

These and other objects are achieved by my invention as will be apparent from the following description taken in accordance with the accompanying drawings, forming a part of this application, in which:

FIG. 1 is a schematic perspective view of the left side of a self-propelled earthworking machine wherein a preferred embodiment of my invention is incorporated;

FIG. 2 is a schematic left-side elevational view of a fragment of the machine of FIG. 1;

FIG. 3 is a schematic left-side view of a smaller fragment of the machine of FIG. 1 with the several buckets in the nested position, but with some portions omitted;

FIG. 4 is a schematic plan view of the fragmentary portion shown in FIG. 3; and

FIG. 5 is a view taken at line V-V of FIG. 3.

Referring to the drawing, FIG. 1 illustrates a powered earthworking machine 11, including a front body portion 13, a rear body portion 15, and a middle or main body portion 17.

The front body portion 13 is pivotally connected to the front end of the main or middle body portion 17 by means of a pair of vertically disposed ball and socket arrangements (not shown), and the front body portion 13 is supported upon an axle and a pair of electric motor-driven wheels 19, 21. A directional steering gear-motor 23, having an output pinion 25, is mounted atop the front body portion 13 in such a location and in such a manner that the output pinion 25 engages a sector gear 27 which is fixed to the front end portion of the main or middle body portion 17.

The rear body portion 15 includes a chassis or frame portion 29 which is supported upon a bogey axle and electric motor-driven wheels arrangement 31. An electric power generating plant 33 is mounted on the rear body frame portion 29, as shown in FIG. 1. The rear body portion 15 is fixedly connected to the rear end portion of the main or middle body portion, so that there is no relative movement therebetween. An operator's control station and control console 35 is located in an elevated position at the front end of the rear body portion 15.

The main or middle body portion 17 is an articulated structure comprising a forward middle body portion 37 and a rear middle body portion 39. The forward and rear middle body portions 37, 39, respectively, are pivotally connected together by means of a ball and socket arrangement 41 located on each side of the machine 11; the left side ball and socket arrangement 41 being shown in FIG. 1. The rear middle body portion 39 comprises an open rectangular frame structure having a pair of spaced parallel longitudinal side girders 43, 45 and a transverse rear end girder 46 fixedly connecting the rear ends of the respective longitudinal side girders 43, 45. A pair of upwardly and frontwardly extending arms 47, 49 are welded or otherwise suitably attached to the respective front end portions of the longitudinal side girders 43, 45. The upper extremities of the arms 47, 49 are fixed both to a transversely extending yoke member 51 and to the respective ends of converging arms 53, 55. The frontward extremities of the converging arms 53, 55 are fixed to and support a pinion gear housing 57 on which is suitably mounted an electric motor-driven gear-motor 59 having an output pinion 61. The output pinion is disposed within the pinion gear housing 57 and engages the teeth of a length of rack 63 which is pivotally connected at one end 65 to the forward middle body portion 37, and which is disposed to move freely within the housing 67 in response to the movement of the pinion 61.

Near the front end of the rear middle body portion 39, there is an immovable load carrying bucket 67 which is located between and fixedly connected to the longitudinal side girders 43, 45. The immovable bucket 67 has a generally U-shaped cross-sectional form (a portion of which is shown in FIG. 5) and is supported along its sides by the forward end portions of the longitudinal side girders 43, 45. The front edge of the fixed bucket 67 is provided with a blade 75 which projects downward and forward therefrom. An apron 77 is pivotally mounted on a shaft 79 which is journaled in the arm members 47, 49 so as to be moveable in a vertical plane. An arcuate rack 81 is fixed to the curved front face of the apron and an electric motor-driven gear-motor 83, having an output pinion (not shown) is suitably mounted on the transverse yoke member 51 so that the output pinion drives the arcuate rack 81.

Within the immovable bucket 67 there are three movable buckets 69, 71, 73. The first, second and third movable buckets 69, 71 and 73 respectively, each have U-shaped cross sectional forms which are generally similar to the cross sectional shape of the fixed bucket 67. Each movable bucket fits conveniently and is slideable within the next larger bucket. That is, the third movable bucket 73 is telescopic within the second movable bucket 71; the second movable bucket 71 is telescopic within the first movable bucket 69; and the first movable bucket 69 is telescopic within the immovable bucket 67. The lower rear edge of each movable bucket 69, 71, 73 is suitably reinforced by a transversely extending bar 85. The after edge portion of each bucket 67, 69, 71 and 73 is provided with stop bar segments 87, which are fixed to the inner surface of each bucket, as shown typically in FIG. 1. The bars 87 serves as a travel-stop means for each immediately adjacent telescoping bucket, and for a reciprocating tailgate 89 which is disposed to move longitudinally within the third movable bucket 73 as well as longitudinally of the machine 11. The tailgate 89 includes a vertically disposed plate 91, having a suitable supporting structure 93 fixed to its rearward side, and a length of rack structure 95 which extends rearwardly both from the tailgate 89 and the machine 11. The rack structure 95 and, consequently, the tailgate 89 is actuated in reciprocating motion by the output pinion of an electric motor-driven gear-reduction 97 which is fixedly mounted on the front end portion of the rear body portion 15, as shown in FIG. 1.

The rearward side portion of each movable bucket 69, 71, 73 is provided with a reciprocatingly disposed pair of rollers 99 which engage the upper surface of the longitudinal side girders 43, 45, respectively, and which support a part of the weight of the respective bucket and its load. Each roller 99 is journaled on a shaft 101 which is mounted in a suitable housing structure 103 fixedly attached to each side of the respective movable bucket. The outer portion 105 of the housing structure 103 extends downward a short distance below the top of the side girder 43, as may be seen in FIG. 5, for the purpose of
preventing the respective bucket from moving laterally so far that the rollers 99 become disengaged from the side girder. The upper portion 107 of the housing structure 103 extends upward to a level which is somewhat above the highest level of earth material which may be reasonably loaded in each bucket. The top or upper ends of the housing structure of each bucket are fixedly connected by means of a tubular member 109, as shown in FIG. 1.

On each shaft 101 of the first and second movable buckets 69, 71, there is journaled a pivotal latch device 111 which comprises a body portion 113 having a forward extending catch or pawl portion 115 and an upward extending lever portion 117. The lever arm 117 is generally perpendicular to a line through the pawl portion 115 and the axis of the shaft 101. Furthermore, the lever arm 117 cant outward at substantially the same slope as the side of the respective bucket, and the upper end of each lever arm 117 terminates at a location which is just beyond the vertical plane of the outer edge of the side girders 43, 45. The pawl portion 115 of each latch engages a lug 119 which is fixedly attached to the upper surface of the side girders 43, 45. The lugs 119 are so located that when the movable buckets 69, 71 are telescoped together and into the fixed bucket 67, the latch 111 on each side of each movable bucket engages its respective lug 119. In this manner then, each movable bucket is held and maintained in its telescoped or retracted position.

On each shaft 101 of the third movable bucket 73 there is journaled a pivotal latch 121 which is similar to the latch 111 in that it has the same type of body portion 113 and frontwardly extending catch or pawl portion 115. However, the latch 121 has an upwardly extending lever arm portion 123 that cant backward in a direction that is slightly from the vertical, as may be seen in FIG. 3. And, furthermore, at the upper end of each lever arm 123, there is fixed a horizontal bar member 125 which extends inwardly a sufficient distance so that the inner end portion engages the tailgate 89 occasionally, for a purpose to be explained hereinafter. A lug 119 is fixed on the upper surface of each of the side girders 43, 45 in such a location that, when the third movable bucket 73 is telescoped into the second movable bucket 71 (that is, when it is in its retracted position), the frontwardly extending catch or pawl portion 115 engages the lug 119 and the bucket 73 is, thus, held and maintained in its telescoped (or retracted) position.

A length of chain 127, or other suitable inelastic yet flexible linkages, is connected at one end near the upper extremity of each of the lever arms 117 of the latches 111 which are mounted on the first movable bucket 69, and at the other end to the housing structure 103 of the second movable bucket 71. The attachment locations are preferably at substantially the same height, as may be seen by referring to FIG. 3. Likewise, another length of chain 129 is connected at one end near the upper extremity of each of the lever arms 117 of the latches 111, which are mounted on the second movable bucket 71, and at the other end to the housing structure 103 of the third movable bucket 73.

Now, to understand the operation of the present invention, reference may be made initially to FIG. 1 of the drawing. In the description which follows, it will be convenient to describe a typical loading and unloading cycle of the machine 11 wherein the operation of the present invention will be described.

In this illustrative position illustrated in FIG. 1, the buckets 67, 69, 71 and 73 of the machine 11 are telescoped or nested together and the tailgate 89 is at its forwardmost position. The machine 11 has just finished its load and unload cycle, and all of the buckets are empty. It will be noticed that the apron 77 is in the raised position and the machine is ostensibly ready to commence another loading and unloading cycle. From FIG. 3 it will be seen that the latches of each movable bucket engage their respective lugs and so, when the cycle commences, the movable buckets 69, 71 and 73 are locked in their telescoped or retracted positions relative to the fixed bucket 67. In order to commence loading the machine, the blade 75 is lowered to its predetermined operative level by actuating the gear reduction 89, whereupon the rear middle body portion 39 pivots downwardly, about the ball and socket arrangement 41, with respect to the forward middle body portion 37. The machine 11 is then caused to move forward (from right to left, as viewed in FIG. 1), the blade 75 engaging the earth material being handled, enters the innermost bucket, which is the third movable bucket 73, while, simultaneously, the tailgate 89 is moved backwardly by actuating the gear motor 97 and the rack structure 95. The tailgate 89 is also being urged rearwardly by the incoming earth material, which action tends to pack the material and load the bucket 73. As the tailgate 89 approaches the rear end of the bucket 73, it strikes the inwardly extending horizontal trip bar 125 on each side of the machine, whereupon, the latches 121 of the bucket 73 pivot about their shafts 101 and each of the latches or pawls 115 becomes disengaged from its respective lug 119. The third movable bucket, being released, moves toward the rear of the machine 11. When the tailgate 89 engages the stop bar segments 87, it causes the third movable bucket to move rearwardly. Now, then, the earth material enters the forward end of the second movable bucket 71 while the loaded third movable bucket continues to move rearwardly in response to movement of the tailgate 89. The earth material continues to accumulate in the second movable bucket and it loads as did the third bucket 73. When the forward end of the third bucket approaches the rear end or stop bar segments 87 in the second bucket, the chain 129 becomes taut, or nearly so, and an outwardly responsive movement of the third bucket 73 exerts a tensile force in the chain 129. This force is transmitted to the lever arm 117 of the second bucket and the latches of that bucket pivot so that each pawl 115 disengages from its respective lug 119. By this time, the reinforcing bar of the third movable bucket 73 engages the stop bar segments 87 of the second movable bucket 71 and, in the manner just described, the third movable bucket 73 causes the second movable bucket to move rearwardly. Thereafter, both the third and the second movable buckets (which are now loaded with earth material) move rearwardly simultaneously. Likewise, when the first movable bucket 69 is nearly full, the chain 127 becomes taut, or nearly so, and the latches 117 of the first movable bucket 69 become disengaged from their respective lugs 119. Thereafter, as described previously, the first, second and third loaded movable buckets move rearwardly simultaneously while the earth material enters the fixed or stationary bucket 67. Finally, when the fixed bucket 67 is loaded, the movenmet of the rack 95 is stopped, the blade is raised by actuating the gear reduction 59, and the apron 77 is rotated from its open position to its closed position by actuating the gear motor 83. The machine 11 may now be operated as an earth-moving vehicle which may be used to carry a load of earth material from one location to another.

When it is desired to unload the machine 11, the apron is again pivoted, but only to a selected partially open position. Between the apron and the blade, the earth material will pass or be forced in a spreading action to any preferred depth. The machine, of course, may be moved either forward or backward, or in both directions, to unload and uniformly spread the earth material. The gear reduction 97 is actuated to initially move the tailgate 89 and then the movable buckets successively. When the third movable bucket has completely telescoped the second movable bucket; and when the second has telescoped the first; and when the first has telescoped the fixed bucket, or nearly so, the latches of the
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5 respective first, second and third movable buckets engage their respective lugs, as shown in FIG. 3. The tailgate 89, however, continues to move forward to push the remaining earth material from the fixed bucket. In this condition, the machine is unloaded and the loading-unloading cycle is completed. During the unloading cycle there is sufficient weight of earth material in each bucket to cause the bucket to move forward with the tailgate.

It should be noted that, during the unloading cycle, the latches of the several movable buckets gravitate into engagement with their respective lugs. For example; after the tailgate 89 moves forward, and when it no longer engages the rear-most bucket, the third movable bucket pivot so that the pawl portions thereof rest and slide on the top surfaces of the side girders 43, 45. Later on, when the third movable bucket commences to move toward its telescoped position, the chains 129 slacken and the latches mounted on the second movable bucket tend to gravitate to a position such that the pawl portions thereof rest and slide on the side girders 43, 45. When the third movable bucket approaches its telescoped position the latch pallets 115 override the front portion of the lugs 119 and the pawls become engaged with their respective lugs 119, as may be seen in FIG. 3. Likewise, as each other movable bucket approaches its telescoped position, the latches thereof gravitate to positions so that the latch pallets and slide on the side girders and positively engage their respective lugs. It is to be understood that suitable stop means may be provided to limit the forward travel of each movable bucket; such travel limit being related and coordinated with the positive engagement of the latches of each movable bucket with their respective lugs.

While, in a preferred embodiment of my invention the latches gravitate as described herein, it is recognized that in some applications it may be desirable to incorporate in each latch resilient bias means, such as a suitable form of spring. The resilient bias means would, of course, urge each pawl into positive sliding relation with one of the side girders and would maintain each pawl in positive engagement with its respective lug.

A feature of the present invention is that the latch lugs are mounted on and fixed to the side girders. The latches of the several movable buckets, then, are so mounted that each engages its respective side frame mounted lug. Such arrangement of the lugs and latches of the present invention thus provides a very high degree of ruggedness and durability.

Another feature of the present invention is that the latching and unlatching is positive and effective. The movement of the tailgate, besides controlling the loading compaction and the unloading of the buckets, effectively accomplishes the unlatching and the latching of the third movable bucket in the simple and effective manner hereinbefore described. Moreover, the tailgate moves the buckets successively and, consequently, the respective chains extending between and connecting a respective movable bucket and the lever arm of the latch on an adjacent movable bucket positively acts to unlatch the adjacent movable bucket when it is loaded or nearly loaded. Of course, it should be apparent that the principles of the present invention may be readily and easily applied to earthworking machines having more movable buckets or less than the number which are described herein.

While I have shown my invention in only one form, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various changes and modifications without departing from the spirit thereof.

I claim:

1. A powered earthworking machine comprising: an articulated main frame supported on front and rear axle-wheel assemblies; a fixed load carrying bucket supported by said frame and having a pivotable front end closing apron journaled on said main frame; a blade fixed to the front lower edge of said bucket and extending in a downward and forward direction therefrom; a plurality of movable load-carrying buckets telescopic within each other and within said fixed bucket; a plurality of pawl engaging lugs fixed to each said main frame; a hatch pivotally mounted on each side of each movable bucket; a trip-bar fixed to the front lower edge of each movable bucket and engaging said trip-bars to release the latches mounted on said movable buckets subsequently to the release of the latches attached to said respective movable buckets.

2. A powered earthworking machine comprising: an articulated main frame supported on front and rear axle-wheel assemblies; a fixed load carrying bucket supported by said frame and having a pivotable front end closing apron journaled on said main frame; a blade fixed to the front lower edge of said bucket and extending in a downward and forward direction therefrom; a plurality of movable load-carrying buckets telescopic within each other and within said fixed bucket; a plurality of pawl engaging lugs fixed to each side of said main frame; a hatch pivotally mounted on each side of each movable bucket; a trip-bar fixed to the front lower edge of each movable bucket and engaging said trip-bars to release the latches mounted on said movable buckets subsequently to the release of the latches attached to said respective movable buckets.

3. A powered earthworking machine comprising: an articulated main frame supported on front and rear axle-wheel assemblies; a fixed load carrying bucket supported by said frame and having a pivotable front end closing apron journaled on said main frame; a blade fixed to the front lower edge of said bucket and extending in a downward and forward direction therefrom; a plurality of movable load-carrying buckets telescopic within each other and within said fixed bucket; a plurality of pawl engaging lugs fixed to each side of said main frame; a hatch pivotally mounted on each side of each movable bucket; a trip-bar fixed to the front lower edge of each movable bucket and engaging said trip-bars to release the latches mounted on said movable buckets subsequently to the release of the latches attached to said respective movable buckets.

4. A powered earthworking machine comprising: an articulated main frame supported on front and rear axle-wheel assemblies; a fixed load carrying bucket supported by said frame and having a pivotable front end closing apron journaled on said main frame; a blade fixed to the front lower edge of said bucket and extending in a downward and forward direction therefrom; a plurality of movable load-carrying buckets telescopic within each other and within said fixed bucket; a plurality of pawl engaging lugs fixed to each side of said main frame; a hatch pivotally mounted on each side of each movable bucket; a trip-bar fixed to the front lower edge of each movable bucket and engaging said trip-bars to release the latches mounted on said movable buckets subsequently to the release of the latches attached to said respective movable buckets.
means pivotally mounted on each said movable bucket, each said latch having a pawl engaging a respective lug when each said movable bucket is telescoped within another bucket; a tailgate reciprocable within the innermost movable bucket; flexible linkage means connecting each said movable bucket with the latch means on the preceding movable bucket for releasing the latch means; and means for reciprocating said tailgate and responsive to moving said innermost said movable bucket subsequent to the releasing of their respective latches successively.

4. A powered earthworking machine comprising: an articulated main frame supported on front and rear axle-wheel assemblies; a fixed load carrying bucket supported by said frame and having a pivotable front end closing apron journaled on said main frame; a blade fixed to the front lower edge of said bucket and extending in a downward and forward direction therefrom; a plurality of movable load-carrying buckets telescopic within each other and within said fixed bucket; a plurality of pawl engaging lugs fixed to each side of said main frame; a latch pivotally mounted on each side of each movable bucket, each said latch having a pawl and a pawl actuating lever, each said pawl being engageable with a respective lug when each said movable bucket is telescoped within another bucket; a tailgate reciprocable within the innermost movable bucket; a trip-bar fixed to the pawl actuating lever of each of the latches mounted on the innermost movable bucket and engageable by said tailgate; means for moving said tailgate linearly within said innermost bucket and engaging said trip-bars to release the latches mounted on said innermost movable bucket, continued linear movement thereafter of said tailgate causing the innermost bucket to move linearly therewith and with respect to the latched movable bucket within which the said innermost movable bucket telescopes; flexible linkage means connecting the frame structure of said innermost movable bucket with the pawl actuating lever of each of the latches mounted on the movable bucket within which said innermost bucket telescopes, said linkage means being of a length such as to un latch the associated latch when the linkage means is tensioned; means on said innermost movable bucket engageable with the respective movable bucket within which it telescopes to move said respective movable bucket subsequent to the release of the latches thereto attached; and means on successive movable buckets engageable with the respective movable buckets within which each bucket telescopes to move serially said respective movable buckets subsequently to the release of the latches attached to said respective movable buckets.

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